The Microsporidian *Octosporea muscaedomesticae* as a Pathogen of Larval and Pupal *Phormia regina* (Diptera: Calliphoridae)[1]

John Paul Kramer
Department of Entomology, Cornell University, Ithaca, New York 14850

Received for Publication April 11, 1972

Abstract: The microsporidian *Octosporea muscaedomesticae* Flu can successfully parasitize larval *Phormia regina*. The protozoan appears to attack only the epithelium of the proximal intestine. The disease generated by the protozoan is often complicated by a secondary bacterial infection which becomes systemic. About 90% of the larvae exposed to the pathogen died as larvae or pupae. The few adults produced from the larval cultures exposed to the pathogen were disease-free.

INTRODUCTION

Fantham and Porter (1958) briefly described a microsporidian infection in larval *Musca domestica* and refer to the parasite as *Octosporea muscaedomesticae* Flu. Since no description of the parasite accompanies this observation, the identity of their microsporidian remains uncertain. Hence the present report may be the first to treat this cytozoic parasite in subimaginal hosts. *O. muscaedomesticae* does produce changes in adult *Phormia regina* (Meigen) recognizable as disease by destroying or severely deforming host cells in the posterior portion of the proximal intestine (Kramer, 1966). In the present report we will see that *O. muscaedomesticae* generates disease in subimaginal stages of *P. regina* as well. That the larva and the adult of *P. regina* are both readily infected *per os* by *O. muscaedomesticae* is a noteworthy sidelight since many species of microsporidians that successfully invade holometabolous insects by the oral route attack only one stage or the other.

MATERIALS AND METHODS

About 130 newly hatched *P. regina* larvae were placed on a chunk of pork liver that had been dipped into an aqueous suspension of fresh *O. muscaedomesticae* spores recovered from diseased adults. A control group of newly hatched larvae was placed on a chunk of liver that had been dipped into tap water. Both groups of larvae were obtained from the same disease-free stock culture. After about 70 hours both groups were transferred to fresh liver. Beginning on the sixth day of the experiment dead specimens were

[1] Supported in part by Research Grant AI-09714 from the National Institute of Allergy and Infectious Diseases of the National Institutes of Health, U. S. Public Health Service.

TABLE 1. Mortality and post-mortem findings in *Phormia regina* populations: One exposed to *Octosporea muscaedomesticae* (=Omd.) as first-instar larvae and the other not so exposed.

Stage at Death	Experimentals				Controls		
		Pathogen				Pathogen	
	% Mortality	Omd. only	Omd. & Bacteria	Not det.*	% Mortality	Bacteria only	Not det.*
Immature Larva	12(16/130)**	—	—	12	11(14/130)**	—	11
Mature Larva	33(38/114)	11	25	2	5(6/116)	4	2
Pupa	87(66/76)	2	51	13	19(21/110)	—	21
Larva—Pupa	92(120/130)	13	76	27	32(41/130)	4	34

* Not determined; ** proportion of specimens dying at given stage.

removed daily from each group and each cadaver was studied individually. The mortality and post-mortem findings for subimaginal stages are summarized in Table 1. Post-eclosion findings in adults from both groups are given in Table 2.

RESULTS AND INTERPRETATIONS

Post-Mortem Changes in Larvae. Dead mature larvae were divided into two categories on the basis of their gross appearance: those that were firm of flesh and whitish in color versus those that were soft, elongate, and dark brown. The chyle stomach, proximal intestine, hind intestine, and rectum of specimens in the "white" category were packed with spores of the parasite. Actual growth and multiplication of the parasite appeared to be restricted to the epithelium of the proximal intestine in these specimens (see Figs. 1 and 2). The hemocoel contained few bacteria and no *O. muscaedomesticae*. The internal organs of larvae in the brown category were in varying degrees disorganized or decomposed and putrifying bacteria were found in association with spores of the protozoan in these cadavers. About one-third of the dead mature larvae had succumbed to octosporeosis alone and about two-thirds of them to a combination of octosporeosis and a bacterial infection.

Post-Mortem Changes in Pupae. Individuals dying in the pupal stage were almost always reduced to an amorphous liquefied mass containing both the

TABLE 2. Post-eclosion findings in adult *Phormia regina*: one group from a population exposed to *Octosporea muscaedomesticae* as first-instar larvae and the other from a population not so exposed.

Source	Findings		
	Gross Appearance Normal	Omd. Spores in Meconia	Omd. in Intestines
Exposed Population	10/10*	7/10	0/10**
Unexposed Population	89/89	0/28	not tested

* Proportion of sample positive; ** flies dissected on post-eclosion day 9.

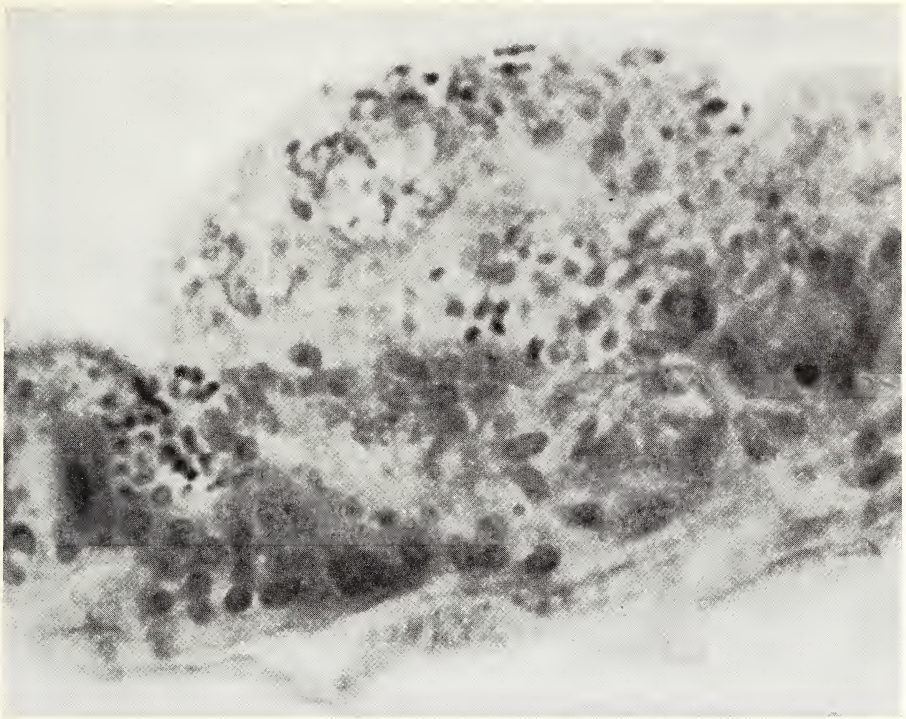

Fig. 1. Portion of a transverse section of the proximal intestine of a diseased *P. regina* larva. Note schizogonic stages of *O. muscaedomesticae* in cell cytoplasm.

protozoan and putrifying bacteria. Two puparial cases contained partly formed flies and octosporeosis alone appeared to be responsible for these deaths.

Observations on Adults. Ten flies were produced from the population exposed to *O. muscaedomesticae*. Seven of these flies produced meconia containing spores of the protozoan. The spores from these meconia were fed to other flies but produced no infection. Apparently the spores had been deactivated in some unknown manner prior to their discharge from the exposed individuals. On post-eclosion day nine all flies in the exposed group were dissected and they proved to be uniformly parasite-free.

DISCUSSION

Whether the octosporeosis generated by *Octosporea muscaedomesticae* occurs in natural populations of larvae has not been demonstrated. Since some subacutely infected flies are highly mobile, they probably do contaminate larval foodstuffs with their spore-filled feces (Kramer, 1965). The extent to which these spores retain their infectivity in decaying organic matter is

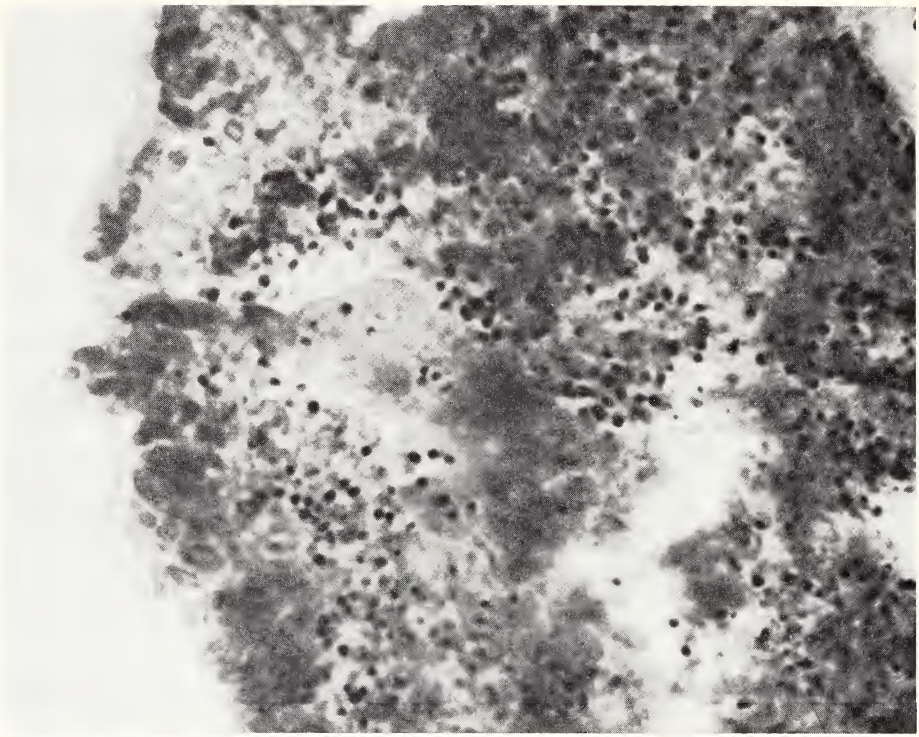

FIG. 2. Portion of a transverse section of the proximal intestine of a diseased *P. regina* larva. Note spores of *O. muscaedomesticae* in cell cytoplasm.

problematical since microsporidian spores can be deactivated in a liquid medium by dense populations of bacteria or fungi (see Kramer, 1970).

The results of this study clearly indicate that *O. muscaedomesticae* can cause a fatal disease in subimaginal *P. regina*. More often than not the disease is complicated by a secondary bacterial infection which becomes systemic. Those adults that developed from an infected culture in the present study were disease-free. Hence there is no evidence to suggest that the parasite can be transmitted from larva to adult via the pupa.

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